



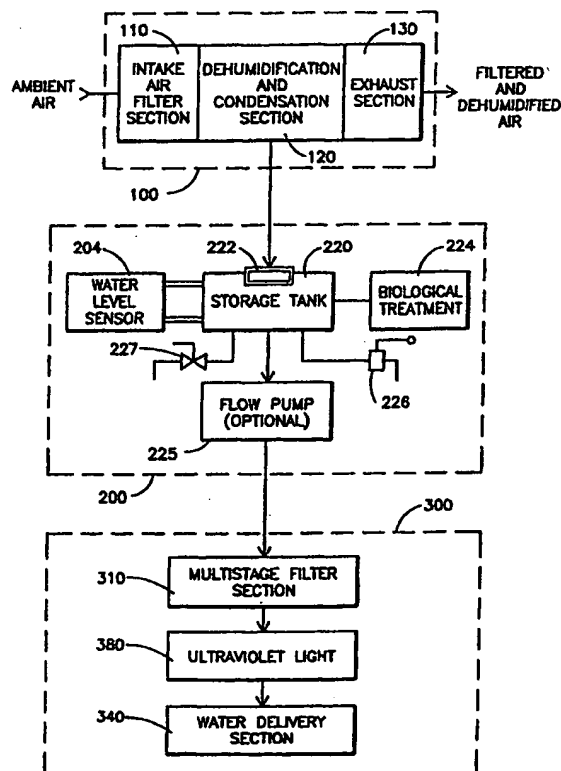
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : <b>F25D 17/06, 21/14, B67D 5/62</b>		<b>A1</b>	(11) International Publication Number: <b>WO 00/14464</b>
			(43) International Publication Date: 16 March 2000 (16.03.00)
(21) International Application Number: <b>PCT/US98/20667</b>		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 1 October 1998 (01.10.98)		<p><b>Published</b> With international search report.</p>	
(30) Priority Data: 09/150,306 9 September 1998 (09.09.98) US			
(71) Applicant: WATER FROM THE AIR, INC. [US/US]; 11680 Pointe Drive, Merritt Island, FL 32952 (US).			
(72) Inventors: GUNN, William, T.; 250 Gamewell Road, S.W., Palm Bay, FL 32908-1207 (US); BAGLEY, Alan, W.; Suite 11, 2600 Kirby Avenue, N.E., Palm Bay, FL 32905-3433 (US); McFADDEN, Warren, A.; 11680 Pointe Drive, Merritt Island, FL 32952 (US).			
(74) Agent: LIVINGSTON, Edward, M.; 628 Ellen Drive, Winter Park, FL 32789 (US).			

(54) Title: AMBIENT AIR WATER EXTRACTION AND SUPPLY APPARATUS AND METHOD

## (57) Abstract

An ambient air water extraction, and purified water supply apparatus includes a sealed water extraction stage (100) that is operative to draw in, filter air (103); and extract water vapor from ambient air to return the filtered, and dehumidified air to the environment. A sealed water storage tank (220) provides biological treatment (224) for water that has been condensed out of the filtered ambient air by the water extraction stage (100). An optional multistage water filtration, and delivery (300) stage installed in a sealed water flow path, with a downstream water flow control mechanism. The multistage filtration section (300) is coupled to the water storage tank (220) through a pressure demand water pump (225) that discharges through a plurality of filters (310) that are effective to filter out particulate, to dissolve chemicals, and biological contaminants. The filtered water is pumped by a water flow pump (225) from the water storage tank for delivery to an optional purified water delivery section (350) that provides, and dispenses potable drinking water in different forms which include room temperature (334), hot (330), cold (332), carbonated (320), flavored soft drink, provides a connection to the refrigerator for chilled water, and ice cubes.



**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

## **AMBIENT AIR WATER EXTRACTION AND SUPPLY APPARATUS AND METHOD**

### **Cross-reference to Related Applications**

The present application claims the benefit of previously filed co-pending  
5 U.S. Provisional Patent Applications, Serial No.60/026,342, filed September 19,  
1996 and EE60978909505, filed May 1,1998.

### **Field of the Invention**

The present invention relates to water supply apparatuses, and is  
particularly directed to a relatively compact, lightweight, economical and portable  
10 apparatus, the internal components of which are sealed from the surrounding  
atmosphere, for extracting water from water vapor in filtered ambient air, and  
then treating, storing, filtering and dispensing purified water, by a water recovery  
scheme that also improves the quality of the air returned to the environment  
through a process of dehumidification, and filtration.

### **Background of the Invention**

Although a variety of water extraction and treatment systems have been  
proposed to date for recovering potable water from the water vapor present in the  
ambient air, each has its own shortcomings, either from a standpoint of  
complexity and energy required (including heat dissipated into the atmosphere),  
20 or its failure to take into account a number of contaminant parameters that may  
be present in the air or in the water being made available for human consumption.  
While many of these Systems are touted as portable, their operation and the  
quality of the water produced by the extraction process is often dependent upon  
the environment in which they operate.

25 For example, while a number of systems are condensation-based, the water  
recovery path to post extraction storage and treatment components may be

exposed to the environment and thereby allow entry of contaminants. In addition, many systems are not readily suited for indoor use for various reasons, one of which is their size or negative impact on the closed environment due to heating and recirculation of contaminants.

- 5       The present invention can be free standing for installation at any selected location within the home, office, in the basement, garage, or any convenient location. An optional enclosure can be provided to match the decor of the location the apparatus is installed in.

#### Summary of the Invention

- 10       In accordance with the present invention, the shortcomings of conventional water supply systems, including portable extraction systems intended for indoor use, are remedied by what is effectively an environmentally friendly water extraction apparatus, that not only provides highly purified water, but also improves the quality of the ambient air from which the water is being extracted  
15       prior to returning the air to the surrounding environment.

- For this purpose, the present invention comprises an integrated arrangement of a water extraction stage, a water collection, chemical addition, storage/reservoir stage, and a water filtration sterilization and delivery stage. The entirety of the air and water processing paths through the integrated multistage  
20       system is sealed from the surrounding environment, so as to prevent entry of contaminants into any part of the system and thereby ensure purity of the water. This sealed configuration of the water extraction, purification, storage, filtration, sterilization, and delivery components of the present invention enables the invention to be utilized in substantially any environment, including those

containing substantial amounts of industrial, agricultural, biological, chemical, and other forms of pollutants.

The water extraction stage is operative to draw in and filter ambient air, and then extract water vapor from the ambient air. Once the drawn-in ambient  
5 air has been dehumidified by the water extraction process, the dehumidified filtered air is returned to the environment.

The water extraction stage resides in a sealed housing, so as to prevent leaks between the external ambient and the interior of the entire water extraction subsystem contained therein. This effectively eliminates any chance of unfiltered  
10 air or other contaminants from entering components of the water extraction stage, as well as downstream water collecting, chemical addition, storage, purification, and delivery subsystems.

By means of a forced air unit, ambient air is drawn through an air inlet port to an intake air filter section that includes an active, small particle  
15 (electrostatic) filter. This filter serves to filter the intake air of all dust, mold, animal dander, or any unwanted air-borne particles. The filtered intake air is then drawn through a water extraction (evaporation and condensation) section, which contains an evaporator and condenser coil arrangement, that condenses water from water vapor in the filtered intake air, prior to the air being returned to the  
20 surrounding environment. An optional deicing heater element or an automatic hot-gas defrost to prevent freezing of the evaporator coils when the unit is operating in temperatures below sixty-five degrees Fahrenheit, can be provided.

The forced air unit is controlled in accordance with the output of a high level sensor, sensing the water level in the collection tank of the water collection  
25 stage. The forced air unit is activated (draws air into the system), as long as the high water level sensor element detects that the water within the storage tank is

below a prescribed "high" level (i.e., the water storage tank is less than a predetermined level). As condensed water is collected, it is channeled through a water collection conduit to the water storage tank. When the water level sensor detects that the storage tank is full, the various powered components of the water  
5 extraction section are turned off.

The water storage stage includes a chemical treatment or disinfectant capability to treat stored water that has been condensed out of the filtered ambient air by the water extraction stage. The water filtration stage comprises a water filtration section installed in the water flow path between the water extraction  
10 stage and the storage tank. The water filter filters out, that is, absorbs or blocks, substantially all particulate, as well as dissolved chemicals and biological contaminants that may be in the condensed water.

Alternate filters may be provided to effectively adjust the pH of the water and remove particles of sediment, rust, dirt, and sand; absorb halogens and other  
15 contaminants, eliminating industrial and agricultural residual chemical compounds, as well as herbicides, pesticides, industrial and commercial cleaners and other Trihalomethanes (THMs).

As water is filtered by the filtration section, it flows by gravity into the storage tank.

20 Electrical power for operating the water extraction system of the present invention may be derived from any conventional AC source. In addition, auxiliary power may be supplied by a number of sources, including a commercially available twelve volt direct current wind-driven generator, and a commercially available twelve volt direct current photoelectric solar array,  
25 connected via a switch to a twelve volt direct current storage battery. Also, an auxiliary emergency battery back-up trickle charge circuit may be coupled with

the switch to selectively provide a trickle charge to the battery. The trickle charger keeps the direct current storage battery fully charged, so that the battery can be used to power the extraction stage via the direct current-to-alternating current converter.

- 5           The storage battery can be maintained fully charged, so as to enable the water extraction stage to be operated without conventional power for a limited period.

          The above and other objects, features and advantages of the present invention should become even more readily apparent to those skilled in the art  
10       upon a reading of the following detailed description in conjunction with the drawings wherein there is shown and described illustrative embodiments of the invention.

#### Brief Description of the Drawings

          In the following detailed description, reference will be made to the attached  
15       drawings in which:

**FIG. 1** is a diagrammatic view of the functional architecture of a sealed, purified water supply apparatus in accordance with an embodiment of the present invention;

**FIG. 2** shows the details of the water extraction stage 100 of the apparatus  
20       of **FIG. 1**;

**FIG. 3** shows the details of the optional multistage water filtration and delivery stage of the apparatus of **FIG. 1**; and

**FIG. 4** is a diagrammatic view of sources of optional electrical power supply for operating the purified water supply apparatus of the present invention.

### Detailed Description of the Preferred Embodiment

For purposes of describing the preferred embodiment, the terminology used in reference to the numbered components in the drawings is as follows:

5	100.	water extraction stage	310.	multistage water filtration section
	101.	sealed housing	312.	flow meter
	103.	air inlet port	320.	valve
	104.	condensing coil	321.	pH adjustment filter
	110.	intake air filter section	323.	carbon block filter
10	120.	water evaporation and condensation section	334.	output valve
	122.	primary refrigeration evaporator coil	340.	purified water delivery section
	123.	compressor unit	350.	delivery section
15	124.	fan assembly	372.	water heater
	124H.	de-icing heater element	373.	water cooler
	130.	exhaust section	375.	chilled water supply
20	200.	water storage stage	380.	ultra violet light
	204.	water level sensor	390.	carbonation tank
	220.	water storage tank	391.	mixing valve
	222.	filter	392.	beverage dispenser
	224.	biological treatment	401.	direct current wind-driven generator
25	225.	water flow pump	403.	direct current photoelectric solar array
	226.	hand pump	407.	switch
	227.	gravity drain faucet	410.	direct current storage battery
	300.	water filtration and delivery stage	411.	trickle charger
			412.	DC-AC converter

An embodiment of the purified water supply apparatus of the present invention will now be described with reference to FIGS. 1-4. The overall functional architecture of the invention is shown in FIG. 1, while FIGS. 2 through 4 illustrate the manner in which the components of the respective air and water processing stages of FIG. 1 are interconnected within a relatively space efficient structure, that is portable. When the optional multistage water filtration and delivery stage is added and the components are mounted within a cabinet, it shall be fitted with casters.



The present invention comprises essentially three stages, a sealed, integrated arrangement of a water extraction stage 100, a water storage stage 200, and a water filtration and delivery stage 300. The water extraction stage 100 (shown in detail in FIG. 2) is operative to draw in ambient air, and extract  
5 therefrom water vapor present in the air. The air flow path through the intake air filter section 110 is relatively "upstream" of a water evaporation and condensation section 120. Once the drawn-in ambient air is filtered and dehumidified in the water extraction stage it is then returned to the surrounding environment through an exhaust section 130.

10 The water storage stage 200 includes a storage tank 220, coupled to the water extraction stage 100 through a filter 222 and covered, so as to prevent entry of any contaminants into the collected water flow path to the water storage tank 220, which stores water that has been extracted or condensed out of the filtered ambient air by the water evaporation and condensation section 120 of the  
15 water extraction stage 100.

As water is introduced into the storage tank 220, it receives biological treatment 224 by means of an optional ozone light or ultra violet light to kill any biological contaminant that may be in the water in the storage tank 220. The storage tank water level sensor 204 controls the operation of the evaporation and  
20 condensing section 120 by, among other controls, turns the system ON for low level and OFF for high levels.

Referring now to FIG. 2, the water extraction stage 100 is shown contained in a sealed housing 101 and having an air inlet port 103 through which ambient air enters stage 100. Because the housing 101 is sealed, there are no  
25 leaks between the external ambient and the interior of the entire air intake, water extraction, and air exhaust sections contained therein. This sealing effectively

eliminates any chance of unfiltered air or other contaminants, such as unwanted foreign airborne, insects, mold spores, dust, dust mites, or animal/insect dander from entering the water extraction, water storage, and multistage, filtration, and delivery stage components.

5           The air inlet port is in fluid communication with the intake air filter 110 installed in the air intake stream, through which all air entering the stage must pass. The intake air filter section 110 includes at least one intake air filter, such as an active electrostatic small particle filter 110 (as a non-limiting example). Such filters serve to filter the intake air of all dust, mold, or other unwanted  
10           airborne particles.

          Coupled in the intake airflow path immediately downstream of the intake air filter 110 is the evaporation and condensation section 120. As described briefly above, the water evaporation and condensation section 120 contains at least one water extraction element that is operative to extract water vapor present  
15           in the intake air that has passed through the intake air filter 110 upstream thereof.

          For this purpose, the upstream end of the water evaporation and condensation section 120, contains a first or primary refrigeration evaporator coil 122, which is supplied with refrigerant from a compressor unit 123. An optional downstream second evaporator coil or additional coils, in combination with a pair  
20           of condenser coils, may be used to perform a two-stage process of water extraction and cooling of the air being returned to the surrounding environment.

          This first evaporator coil 122 condenses water vapor present in the filtered intake air as the air passes over the coil. This evaporator coil 122, and associated compressor units employed in the invention may comprise commercially available  
25           components. In order to prevent corrosion and extend the life of the evaporator coils, it is mandatory that the coils be externally coated by a dipping, spraying,

brushing application and/or molecular deposition using a corrosion resistant material for use in potable water systems, approved by NSF and certified to ANSI/NSF 61. An option in association with the primary evaporator coil 122 is a de-icing heater element 124H, upstream of the evaporator coil and/or an automatic hot-gas defrost, which is controllably operative to prevent freezing of the evaporator coil when the unit is operating in temperatures below sixty-five degrees Fahrenheit, may be provided.

Also installed in the water evaporation and condensation section 120, downstream of condensing coil 104 is a forced air unit/fan assembly 124, which is controllably operative to draw ambient air into the system. The operation of the fan assembly 124 is controlled in accordance with the output of a high/low level sensor of the water storage tank 220 of the water storage stage 200. In particular, the fan assembly 124 is activated to draw air into the system, as long as the water level sensor element detects that the quantity or volume of water within the storage tank 220 is below a prescribed "full" or "high" level. However, when the high level sensor detects that the storage tank 220 is full, the various powered components of the water extraction stage 100, including the compressor(s) of the evaporator 122 and condenser unit(s) 104 and the forced fan 124 are turned off (as a non-limiting example).

As an option in the airflow path immediately downstream of the fan assembly 124, an arrangement of one or more evaporator and condenser coils may be installed, comprising respective primary and secondary coils over which the drawn-in and filtered intake air passes. These coils condense/extract water from the water vapor in the air flowing through the water extraction stage 100. The condensed water drips through a filter element 222 into a storage tank 220

attached to the sealed housing of water extraction stage 100 and is channeled into the water storage tank 220.

FIGS. 1 and 2 show the water filter 222 and storage tank 220. The filtered water in the storage tank 222 is biologically treated with an optional ozone or ultraviolet light or other biological treatment.

As pointed out above and shown in FIG. 1, water usage is monitored by a water level sensor unit 204. The water level sensor 204 is operative to control the operation of the components of the water extraction stage 100, described above, including its fan and compressor units, in accordance with the water level within the water collection tank 220. As long as the water collection tank 220 is below the set point, the water extraction stage 100 is operative to draw ambient air into the system, and causing water vapor in the intake air to be extracted, collected, and supplied to the water storage stage 200. However, when the water level sensor 204 detects a "full" tank condition, it shuts off driven components [compressor(s), fan unit(s)] of the water extraction stage 100.

An optional water flow pump 225 may be provided and controlled by an internal pressure switch which activates the pump on low discharge head and stops the pump when set pressure is obtained.

The flow pump 225 delivers water under pressure to remote locations and to the refrigeration for chilled water or to the ice cube maker, additional filtration may be provided at the output of the water flow control pump 225. As described below, through a series of progressively finer porosity filters, the multistage water filtration and delivery stage 300, effectively filters out (absorbs/blocks) substantially all particulate, chemical, and biological contaminants from the treated water as its being pumped from the storage tank 220 for delivery to one or more water outlet valves of an optional purified water delivery section 340.

More particularly, an optional multistage water filtration section 310 may be provided to include an optional pH adjustment filter 321, such as a calcite filter or a 10 micron sediment filter.

5 The next filter may be a resin bead, a demand-release ionized disinfectant filter or a 0.5 micron carbon block filter 322 that absorbs chemical components, such as halogens (e.g., chlorine, bromine, iodine) and other chemicals, including industrial and agricultural residual chemical compounds, to improve taste, smell, and quality of water.

10 The final filter element of the multistage filtration section is a 0.5 or a 5.0 micron carbon block filter 323 installed downstream of the 0.5 micron carbon block filter 322. This filter also filters out herbicides, pesticides, industrial and commercial cleaners and other Trihalomethanes (THMs). The carbon block filter 323 may also contain an ultra violet light to kill viruses and bacteria which may be in the water.

15 This and other different combinations of filters at filter locations 321, 322, and 323 may be used to suit the user.

As water is pumped through the multistage filtration section 310, it is monitored via a flow meter 312, installed in the water flow path. Flow meter 312 prevents the flow of water through the water flow path to the purified water  
20 delivery section 340, when the system has reached a maximum gallon usage (e.g., 1200/1500 gallons), and the water filters require replacement.

As water is pumped through the multistage filtration section 310 it is supplied directly to the purified water delivery section 340, which provides the purified water on demand by way of output valves of a multi-tap water dispensing  
25 system. As described above, and as diagrammatically illustrated in FIG. 3, the purified water delivery section 340 is configured not only to directly deliver

purified room temperature water as filtered by the multistage filtration section 310, but contains a plurality of purified water conduits, that are respectively coupled to a water heater 372, a water cooler 373, a direct feed room temperature output valve 334, and a supply valve to the refrigerator ice maker and/or chilled water supply 375. In addition, it may be coupled to a flavoring additive supply tank which stores a flavoring additive, such as a flavored soft drink syrup and a carbonation tank 390. A mixing valve 391 thus allows the water to be mixed with additives (e.g., flavoring and/or carbonation), as desired to be delivered from a beverage dispenser 392 through a valve 320.

10       The demand for water is sensed by operation of one of the water output valves of the multi-tap water dispensing system. This causes a reduction in the water pressure in the water flow path, which is sensed by a low pressure sensor in the pressure demand pump 225, activating the water pump 225, causing the water pump 225 to pump water through the multistage filtration section 310 to the  
15       purified water delivery section 340.

As described above, electrical power for operating the water extraction and purification system of the present invention may be derived from any conventional AC source, such as 110 VAC, 60 Hz, 230 VAC, 60 Hz, or 208 VAC, 50 Hz.

20       In addition, as diagrammatically illustrated in FIG. 4, optional auxiliary emergency power for operating subsystem water supply components may be supplied by a number of sources. These sources include a commercially available 12 volt direct current wind-driven generator 401, and a commercially available 12 volt direct current photoelectric solar array 403, which are connected via  
25       external connection terminals and a switch 407 to a 12 volt direct current storage battery 410.

A DC-AC converter 412 is coupled to storage battery 410 for supplying emergency 110 VAC power or an optional voltage and frequency. An auxiliary emergency (power outage) battery back-up trickle charge circuit 411 may also be coupled in the circuit with the switch 407, to selectively provide a trickle charge  
5 to the battery 410. The trickle charger 411 keeps the 12 volt direct current storage battery 410 fully charged. Storage battery 410 maintains a full charge, so as to enable the water pump associated with the output taps of the water dispenser, to be operated, without conventional power. Thus, in the event of a power outage, the auxiliary power supply will at least power those components  
10 that will allow the user to be supplied with whatever water is in the water storage tank 220.

Units without the optional pressure demand flow pump 225 and multistage water filtration and delivery stage 300 are provided with a gravity drain faucet 227 on the storage tank 220 and/or an optional hand pump 226 to deliver pure  
15 water for consumption, as shown in FIGS. 1 and 2.

As will be appreciated from the foregoing description, the present invention provides a relatively compact, integrated and sealed purified water supply apparatus that is not only operative to extract, store, and purify water from water vapor in ambient air, but prevents entry of contaminants in the  
20 surrounding atmosphere from entering the system. The ambient air intake filtering section employs an active electrostatic filter which reduces airborne contaminants prior to extracting water from the air assuring water purity. Thus, when the filtered air is exhausted to the surrounding atmosphere it improves the air quality as well.

25 The optional multistage water and delivery filtration section 310, provides superior water purification, eliminating ninety-nine percent of bacteria, viruses

and other microorganisms, ninety-seven percent of industrial and agricultural chemicals, and ninety-nine percent of herbicides, pesticides, solvents and other Trihalomethanes (THMs). In addition, the ultra violet light 380 is destructive to bacteria, mold, and viruses that may be in the water after filtration.

5        This highly purified water is available to the user in a variety of optional modes by way of the purified water delivery section 340, and the optional delivery section 350.

      Results of analysis of water extracted and purified by the present invention have shown a remarkable purity of the water, which is understood to far exceed  
10       requirements of the U.S. Environmental Protection Agency (EPA). Indeed, tests have shown that purified water provided by the extraction, treatment and filtration system of the present invention is free of ninety-nine percent (99%) of all bacteria, viruses and other microorganisms, herbicides, pesticides, industrial and commercial cleaners and other Trihalomethanes (THMs), and ninety-seven  
15       percent (97%) of chemical contaminants, including industrial and agricultural residual chemical compounds.

      While we have shown and described an embodiment in accordance with the present invention, it is to be understood that the same is not limited thereto but is susceptible to numerous changes and modifications as are known to a person  
20       skilled in the art, and we therefore do not wish to be limited to the details shown and described herein, but intend to cover all such changes and modifications as are obvious to one of ordinary skill in the art.



### Claims

Having thus described our invention, we claim:

- 1           1.     An ambient air water extraction apparatus comprising:  
2                     a water extraction stage having an intake air filter section, said intake  
3     air filter section including an air inlet port, and containing at least one intake air  
4     filter through which intake air passes, an evaporation and condensation section  
5     coupled in an air flow path with said intake air filter section, and containing at  
6     least one water extraction element that is operative to extract water vapor present  
7     in air that has passed through said intake air filter section and an exhaust air  
8     section coupled in an air flow path with said evaporation and condensation section  
9     to exhaust the filtered, dehumidified air to a surrounding atmosphere; and  
10                    a water storage tank coupled in sealed communication with and being  
11     operative to store water supplied thereto from said water extraction stage.
  
- 1           2.     An ambient air water extraction apparatus according to claim 1,  
2     further including a forced air mechanism which is operative to force air through  
3     said intake air filter section, said evaporation and condensation section and  
4     exhaust the filtered and dehumidified air to the surrounding atmosphere.
  
- 1           3.     An ambient air water extraction apparatus according to claim 2,  
2     wherein said forced air mechanism is operative to force air out of the apparatus  
3     into the surrounding atmosphere.
  
- 1           4.     An ambient air water extraction apparatus according to claim 2,  
2     wherein said water storage tank contains a water level sensor that controls the

3 operation of said forced air mechanism in accordance with the water level in the  
4 said water storage tank.

1       5.     An ambient air water extraction apparatus according to claim 4,  
2 further including an optional water flow pump control coupled with said water  
3 flow path from said water storage tank and being controllably operative to pump  
4 water through said water flow path for delivery by said water flow control pump  
5 to at least one water outlet port.

1       6.     An ambient air water extraction apparatus according to claim 1,  
2 wherein said evaporation and condensation section contains a first evaporator coil  
3 unit installed at a relatively upstream portion of said evaporation and  
4 condensation section, and an optional second evaporator coil unit installed at a  
5 relatively downstream portion of said evaporation and condensation section.

1       7.     An ambient air water extraction apparatus according to claim 6,  
2 wherein said evaporation and condensation section further includes at least one  
3 optional condenser coil coupled in an air flow path past said first and optional  
4 second evaporator coils.

1       8.     An ambient air water extraction apparatus according to claim 7,  
2 further including a forced air mechanism, which is operative to force air through  
3 said intake air filter section, said evaporation and condensation sections and said  
4 air exhaust to a surrounding environment.

1           9.    An ambient air water extraction apparatus according to claim 1,  
2 wherein an optional said multistage filtration section may be provided to include  
3 a sequential arrangement of at least one of a pH adjustment filter, a sediment  
4 filter, a first carbon block absorption filter, downstream of said adjustment filter  
5 and sediment filter, a second carbon block absorption filter downstream of and  
6 having a finer porosity than said first carbon filter, said first and second carbon  
7 block absorption filters being operative to block chemical and biological  
8 contaminants, and an extraction filter downstream of said second carbon block  
9 absorption filter being operative to block biological contaminants.

1           10.   An ambient air water extraction apparatus according to claim 1,  
2 further including an optional biological treatment dispenser coupled with said  
3 water storage tank and being operative to dispense biological contaminant  
4 treatment material into water stored in said storage tank.

1           11.   The ambient air water extraction apparatus of claim 10 wherein the  
2 biological containment treatment material consists of at least one of ozone or ultra  
3 violet light.

1           12.   An ambient air water extraction apparatus according to claim 1,  
2 further including an optional purified water delivery section coupled with the  
3 optional said multistage filtration section and said at least one water outlet port,  
4 and being operative to control at least one characteristic of water that has been  
5 filtered by said multistage filtration section.

1           13. An ambient air water extraction apparatus according to claim 12,  
2 wherein said optional purified water delivery section is operative to control at  
3 least the water temperatures (hot, cold, and ambient).

1           14. An ambient air water extraction apparatus according to claim 1,  
2 further including an optional water flow pump coupled with said water flow path  
3 from said water storage tank and being controllably operative to pump water  
4 through said water flow path and through said multistage water filtration and  
5 delivery section for delivery to at least one water outlet port, and including a  
6 water flow meter which is operative to controllably disable the operation of said  
7 water flow pump in response to a prescribed volume of water flow through said  
8 multistage water filtration and delivery section.

1           15. An ambient air water extraction apparatus comprising:  
2           a sealed water extraction stage that is operative to draw in, filter and  
3 extract water vapor from ambient air, and to provide filtered processed air that  
4 has been dehumidified by water extraction before being returned to a surrounding  
5 environment;

6           a water storage stage, coupled in sealed fluid communication with  
7 said water extraction stage and being operative to treat and store water that has  
8 been condensed out of the filtered ambient air by said water extraction stage; and

9           an optional multistage water filtration and delivery stage installed in  
10 a sealed water flow path through a water flow control mechanism that is coupled  
11 in said sealed water flow path with said water collecting, filtration, biological  
12 treatment, and storage stage, said multistage water filtration and delivery stage  
13 containing a plurality of filters that are effective to filter out particulate, dissolved

14 chemicals and biological contaminants from water pumped by a water flow  
15 control pump prior to said delivery to one or more water outlet ports.

1       16. An ambient air water extraction apparatus according to claim 15,  
2 wherein said water extraction stage includes a forced air unit, that is controllably  
3 operative to draw ambient air through an intake air filter section that filters the  
4 air of unwanted airborne particles, and through a water evaporation and  
5 condensation section, containing an evaporator and condenser coil arrangement  
6 that condenses water form water vapor in the filtered intake air, prior to its being  
7 returned to the surrounding environment.

1       17. An ambient air water extraction apparatus according to claim 16,  
2 wherein said forced air unit and said evaporation and condensing section are  
3 controlled in accordance with the water quantity in said water storage tank.

1       18. An ambient air water extraction apparatus according to claim 17,  
2 further including an optional flow meter which monitors the flow of water  
3 pumped through an optional said multistage water filtration and delivery stage,  
4 and being operative to shut down said water pump, and thereby prevents the flow  
5 of water, in response to a water usage associated with the need to replace said  
6 water filters.

1       19. An ambient air water extraction apparatus according to claim 15,  
2 further including an optional purified water delivery section that supplies purified  
3 water on demand by way of output valves of an optional multi-tap purified water  
4 delivery section.

1        20. An ambient air water extraction apparatus according to claim 1,  
2 wherein electrical power for operating of components of said ambient air water  
3 extraction apparatus is derivable from optional power sources and at selected  
4 voltages and frequencies to suite available power supplies.

1        21. An ambient air water extraction apparatus according to claim 15,  
2 further including an optional purified water delivery section coupled to said  
3 multistage water filtration and delivery stage that provides, and dispenses potable  
4 drinking water in different forms which include at least one of room temperature,  
5 hot, cold, carbonated and/or flavored.

1        22. A method of supplying water comprising the steps of:

2            (a) filtering and dehumidifying ambient air in a sealed  
3 housing, so as to extract water therefrom and return dehumidified  
4 and filtered ambient air to the surrounding environment;

5            (b) filtering, biologically treating and storing, in a sealed  
6 water storage tank, water that has been extracted in step (a) and  
7 supplied to said storage tank by way of a filter through a water flow  
8 path that is sealed from said surrounding environment; and

9            (c) delivering potable water by passing water that has been  
10 treated and stored in step (b) through a plurality of water filters that  
11 filter out additional particulate, dissolved chemicals and biological  
12 contaminants from said water, then expose the purified water to an  
13 ultra violet light and delivering purified water to one or more water  
14 outlet ports.

1           23. A method according to claim 22, wherein step (a) comprises drawing  
2 said ambient air into said sealed housing through an air filter that filters said  
3 ambient air of unwanted airborne particles, and through a water evaporator and  
4 condenser coil arrangement installed in said sealed housing that condenses water  
5 from water vapor in air filtered by said air filter, prior to its being returned to the  
6 surrounding environment.

1           24. A method according to claim 22, wherein steps (a) and (c) are  
2 controlled in accordance with the water quality in said water collection tank.

1           25. A method according to claim 22, wherein step (c) further includes  
2 optionally monitoring the flow of water passing through said plurality or the  
3 multistage water filtration and delivery stage and interrupting the flow of water  
4 therethrough, in response to a water usage associated with the need to replace  
5 said plurality of optional water filters.

1           26. A method according to claim 22, wherein step (c) includes delivering  
2 said purified water using either one of a gravity drain faucet or optional hand  
3 pump through an optional said one or more water outlet ports by means of a  
4 purified water delivery section that supplies purified water on demand by way of  
5 output valves.

1           27. A method according to claim 22, wherein step (c) includes  
2 dispensing purified water in different forms, which include at least one of a room  
3 temperature, hot, cold, carbonated, flavored or frozen water.

1           28. A method according to claim 22, wherein steps (a) and (c) are  
2 performed by electrically driven components, and wherein electrical power for  
3 operating at least one or more of said electrically driven components is derivable  
4 from alternate power supplies including various voltages, frequencies, from one  
5 or more sources.



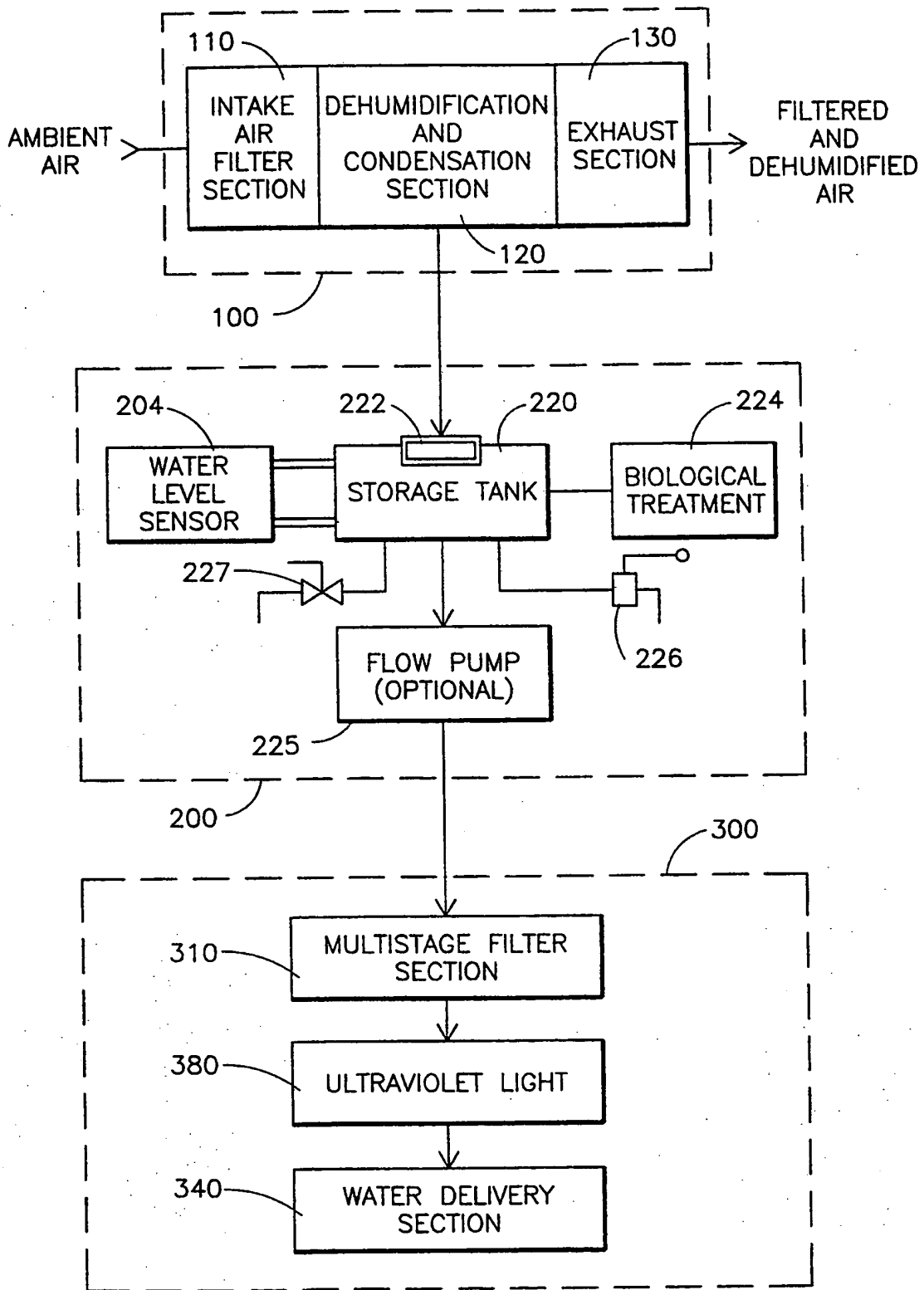


FIG. 1

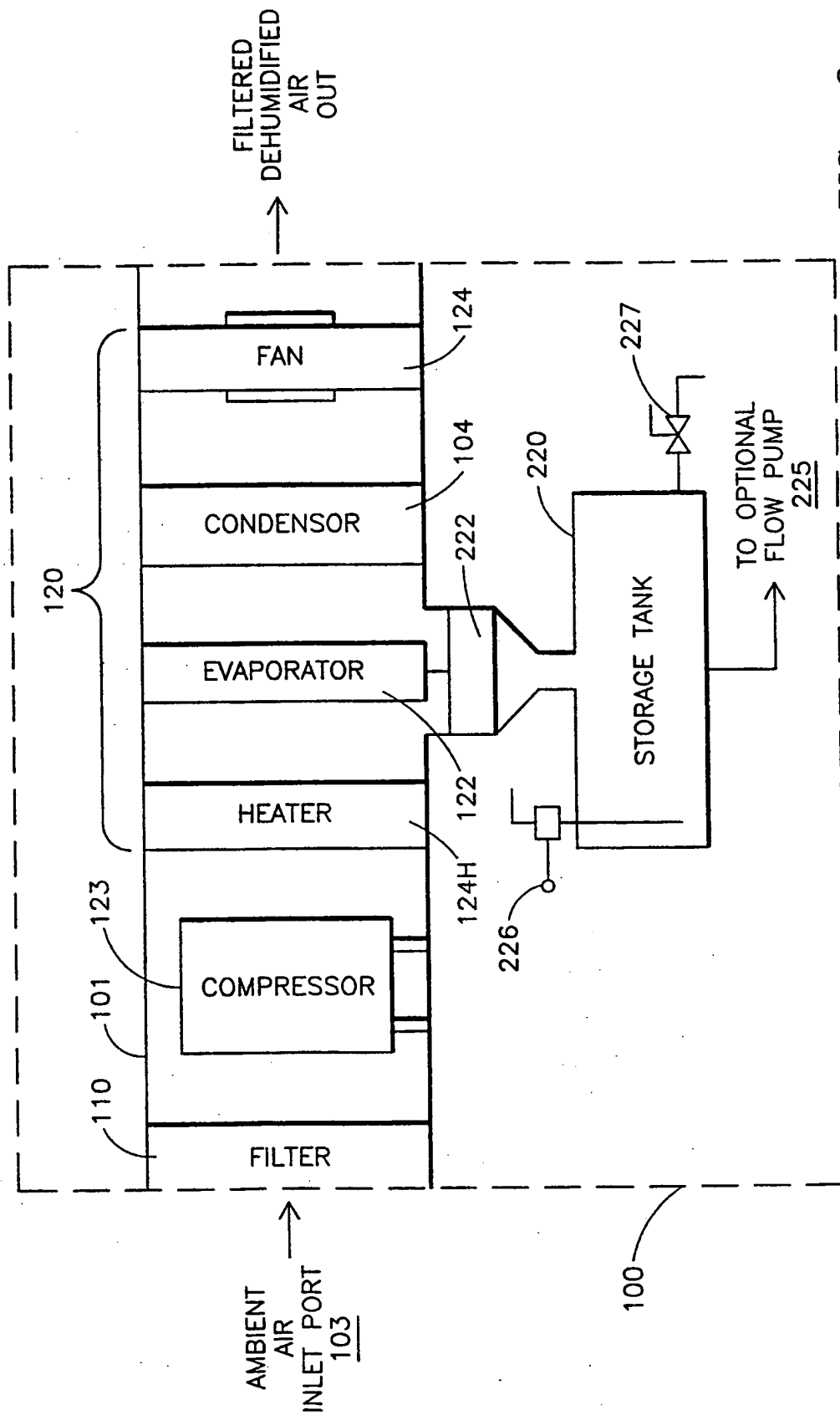


FIG. 2

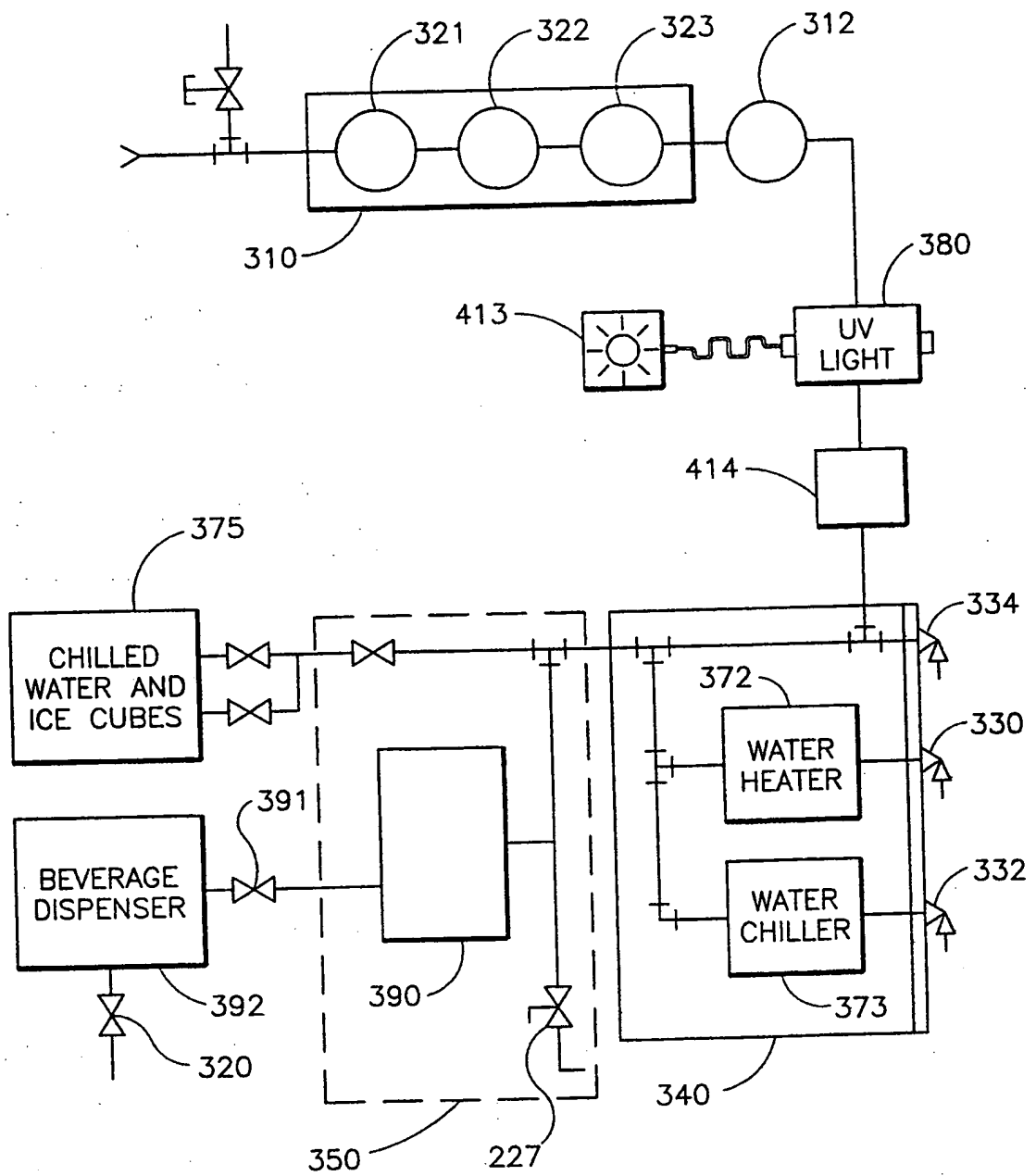


FIG. 3

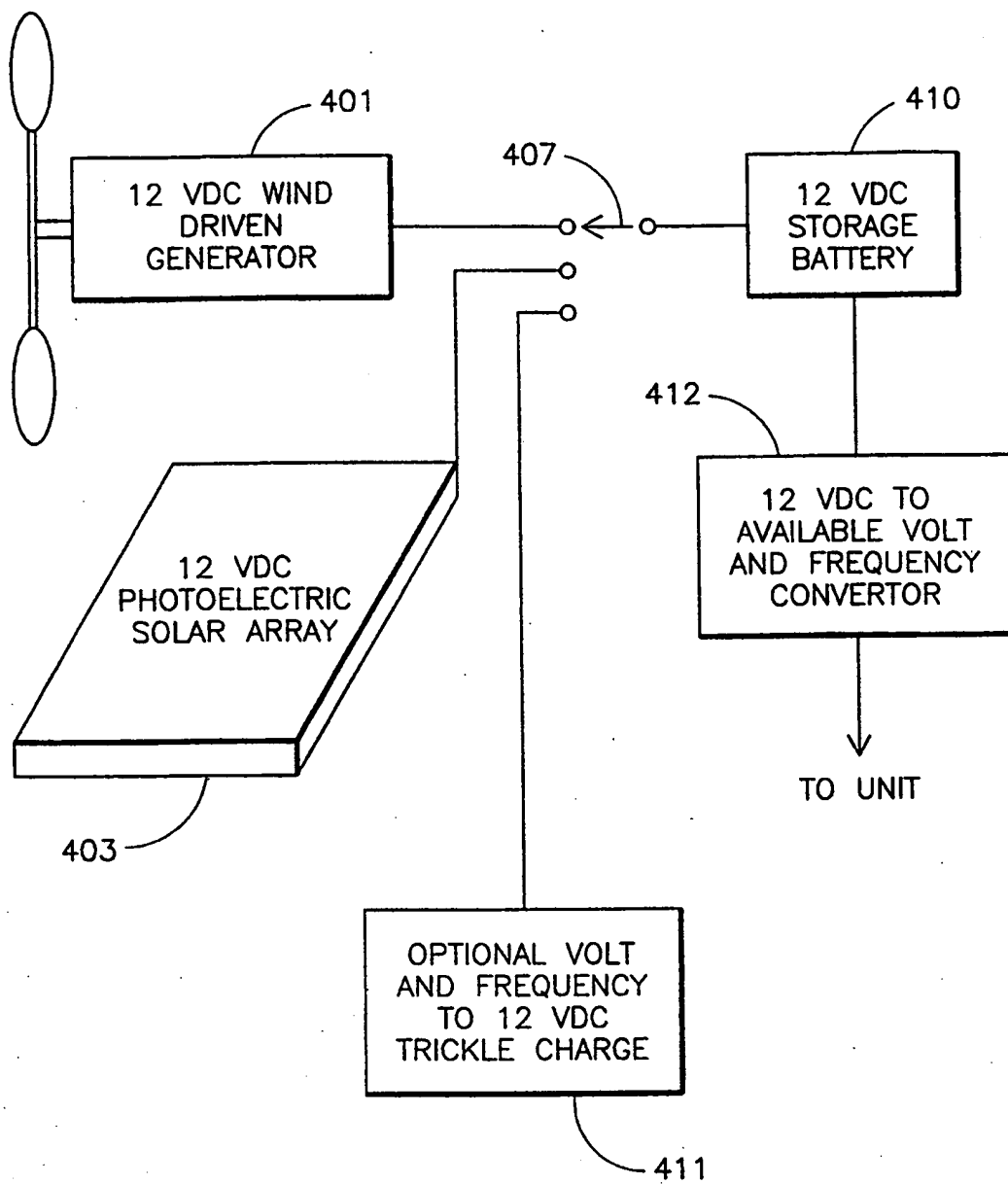
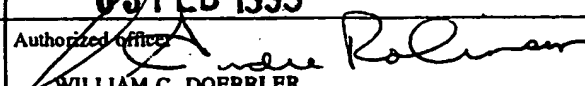


FIG. 4

## INTERNATIONAL SEARCH REPORT

 International application No.  
 PCT/US98/20667

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(6) : F25D 17/06, 21/14; B67D 5/62 US CL : 62/93, 150, 291 According to International Patent Classification (IPC) or to both national classification and IPC				
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 62/93, 150, 272, 291, 389-391; 210/669, 681, 754, 764 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)				
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	US 5,259,203 A (ENGEL et al) 09 November 1993, see entire document.	1-3, 6-10, 12, 13		
X	US 5,517,829 A (MICHAEL) 21 May 1996, entire document.	1-3, 9, 10, 12, 15, 16, 19, 20-23, 27		
X	US 5,701,749 A (ZAKRYK) 30 December 1997, entire document.	1-5, 9, 14-17, 21-26		
X	US 5,106,512 A (REIDY) 21 April 1992, entire document.	1-5, 9-12, 14-28		
X	US 5,669,221 A (LEBLEU et al) 23 September 1997, entire document.	1-28		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.				
<table border="0"> <tr> <td>           * Special categories of cited documents:            *A* document defining the general state of the art which is not considered to be of particular relevance            *B* earlier document published on or after the international filing date            *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)            *O* document referring to an oral disclosure, use, exhibition or other means            *P* document published prior to the international filing date but later than the priority date claimed         </td> <td>           *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention            *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone            *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art            *A* document member of the same patent family         </td> </tr> </table>			* Special categories of cited documents: *A* document defining the general state of the art which is not considered to be of particular relevance *B* earlier document published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art *A* document member of the same patent family
* Special categories of cited documents: *A* document defining the general state of the art which is not considered to be of particular relevance *B* earlier document published on or after the international filing date *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art *A* document member of the same patent family			
Date of the actual completion of the international search 05 JANUARY 1999		Date of mailing of the international search report 08 FEB 1999		
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230		Authorized officer  WILLIAM C. DOERRLER Telephone No. (703) 308-0696		

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US98/20667

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,669,221 A (LE BLEU et al) 23 September 1997, entire document.	1-28
A	US 5,514,344 A (D'AGARO) 07 May 1996, entire document.	10
A	US 5,729,981 A (MARKUS et al) 24 March 1998, col 3 lines 3-6.	20, 28